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Signed

Dated 12 February 2004

Patents Form 1/77

Patents Act 1977
(Rule 16)

THE PATENT OFFICE
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- 4 APR 2003
NEWPORT

The Patent Office

04APR03 E797807-1 C64191
P01/7700 0.00-0307804.5

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ

1. Your reference STEPWING

2. Patent application number *(The Patent Office will fill in this part)* 0307804.5 - 4 APR 2003

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

ADRIAN ALEXANDER HUBBARD
39, EGERTON ROAD
BUSHBURY
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WV10 8AU

Patents ADP number *(if you know it)* 7933401001

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

HIGH LIFT AND HIGH STRENGTH AEROFOIL SECTION

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

39, EGERTON ROAD
BUSHBURY
WOLVERHAMPTON
WEST MIDLANDS
WV10 8AU

Patents ADP number *(if you know it)*

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

NO

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	0 SHEETS
Description	3 SHEETS
Claim(s)	3 SHEETS
Abstract	1 SHEETS
Drawing(s)	7 SHEETS

RM.

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	ONE SEARCH COPY
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature A. Hubbard Date 2/4/03

12. Name and daytime telephone number of person to contact in the United Kingdom

ADRIAN HUBBARD
01902 654568

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) *If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.*

b) *Write your answers in capital letters using black ink or you may type them.*

c) *If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.*

d) *If you have answered 'Yes' Patents Form 7/77 will need to be filed.*

e) *Once you have filled in the form you must remember to sign and date it.*

f) *For details of the fee and ways to pay please contact the Patent Office.*

HIGH LIFT AND HIGH STRENGTH AEROFOIL SECTION

Conventional aerofoils have usually quite small thickness compared to their chord and it is difficult to provide adequate strength if they are to be efficient, especially in high speed operation. This invention relates to a high lift aerofoil section, incorporating a step, to provide a higher vertical component in its construction; the aerofoil has greater perceived root thickness giving greater lift through compression on the aerofoil undersurface, and much higher strength to the aerofoil on all axes than conventional aerofoil sections.

According to the present invention there is provided conventional section aerofoil which has a step incorporated within its chord, wherein the step is defined as a substantial difference between the level of the leading edge and the level of the trailing edge of the aerofoil at zero angle of attack. The step is confined around the aerofoil chord centre; the length of the step is between one third and two thirds of the aerofoil chord. The depth of the step is between one half of aerofoil thickness and three times aerofoil thickness, depending on the aerofoil application. The step is blended into the aerofoil profile as neatly as possible to create a smooth and aerodynamic airflow over the section. This aerofoil section can be utilised in a number of aerofoil applications including: - aircraft wings, helicopter rotor blades, aircraft propellers, turbofan fan blades etc.

Figure 1 illustrates a typical stepped section aerofoil.

Figure 2 illustrates the section of a high aspect ratio aircraft wing incorporating a step.

Figure 2A illustrates the underside of a high aspect ratio aircraft wing incorporating a step.

Figure 2B illustrates the front view of a high aspect ratio aircraft wing incorporating a step.

Figure 3 illustrates the section of a low aspect ratio aircraft wing incorporating a step.

Figure 3A illustrates the plan view of a low aspect ratio aircraft wing incorporating a step.

Figure 3B illustrates the front view of a low aspect ratio aircraft wing incorporating a step.

Figure 4 illustrates the section of a delta aircraft wing incorporating a step.

Figure 4A illustrates the plan view of a delta aircraft wing incorporating a step.

Figure 4B illustrates the front view of a delta aircraft wing incorporating a step.

Figure 5 illustrates the section of a helicopter rotor blade incorporating a step.

Figure 5A illustrates the plan view of a helicopter rotor blade incorporating a step.

Figure 6 illustrates the section of an aircraft propeller blade incorporating a step.

Figure 6A illustrates the front view of aircraft propeller blades incorporating a step.

Figure 7 illustrates the section of a turbofan fan blade incorporating a step.

Figure 7A illustrates the front view of a turbofan fan blades incorporating a step.

Referring to the drawings the aerofoil has a leading edge 1, a stepped section 2 and a trailing edge 3. The step 2 creates compression 4 on the undersurface of the section giving a high pressure area 5 below the aerofoil; above the aerofoil is a low pressure area 6, see Figure 1.

Referring to Figure 2 the stepped aerofoil is incorporated into a high aspect ratio aircraft wing. The step depth is between half of wing thickness and once wing thickness at the wing root. The step tapers, from maximum depth inboard, to zero depth at the wing tip, see Figures 2A and 2B.

Referring to Figure 3 the stepped aerofoil is incorporated into a low aspect ratio aircraft wing. The step depth is between once wing thickness and twice wing thickness at the wing root. The step tapers, from maximum depth inboard, to zero depth at the wing tip, see Figures 3A and 3B.

Referring to Figure 4 the stepped aerofoil is incorporated into a delta aircraft wing. The step depth is between twice wing thickness and three times wing thickness at the wing root. The step tapers, from maximum depth inboard, to zero depth at the wing tip, see Figures 4A and 4B.

Referring to Figure 5 the stepped aerofoil is incorporated into a helicopter rotor blade. The step depth is between half of blade thickness and twice blade thickness. The step is not tapered and the depth is constant along the whole blade, see Figure 5A.

Referring to Figure 6 the stepped aerofoil is incorporated into an aircraft propeller blade. The step depth is between half of blade thickness and twice blade thickness. The step is not tapered and the depth is constant along the whole blade, see Figure 6A.

Referring to Figure 7 the stepped aerofoil is incorporated into a turbofan fan blade. The step depth is between half of blade thickness and twice blade thickness at the blade tip. The step tapers, from maximum depth outboard, to zero depth at the root, see Figure 7A.

The stepped aerofoil is able to be used for a great many applications which require aerofoils; for lift or downforce, thrust or suction or for turbine blades.

CLAIMS

What is claimed is:-

1. An aerofoil incorporating a step along its chord, wherein said step is defined as a substantial difference between the level of the leading edge and the level of the trailing edge of said aerofoil at zero angle of attack;

said step is confined around the aerofoil chord centre;

said step length is between one third and two thirds of length of said aerofoil chord;

said step provides compression beneath said aerofoil at speed;

said step provides a high pressure area below said aerofoil at speed;

said step provides a low pressure area above said aerofoil at speed;

said step provides said aerofoil with greater perceived thickness;

said step provides said aerofoil with greater strength in all axes than a conventional aerofoil;

said step is blended into said aerofoil profile as neatly as possible to create a smooth and aerodynamic airflow over the section.

2. An aerofoil as claimed in claim 1 manufactured as a high aspect ratio aircraft wing incorporating said step;

said step depth is between half of said wing thickness and once said wing thickness at said wing root;

said step tapers, from maximum depth inboard of said wing, to zero depth at the tip of said wing.

3. An aerofoil as claimed in claim 1 manufactured as a low aspect ratio aircraft wing incorporating said step;

said step depth is between once said wing thickness and twice said wing thickness at said wing root;

said step tapers, from maximum depth inboard of said wing, to zero depth at the tip of said wing.

4. An aerofoil as claimed in claim 1 manufactured as a delta aircraft wing incorporating said step;

said step depth is between twice said wing thickness and three times said wing thickness at said wing root;

said step tapers, from maximum depth inboard of said wing, to zero depth at the tip of said wing.

5. An aerofoil as claimed in claim 1 manufactured as a helicopter rotor blade incorporating said step;

said step depth is between half of said blade thickness and twice said blade thickness along the whole length of said blade.

6. An aerofoil as claimed in claim 1 manufactured as an aircraft propeller blade incorporating said step;

said step depth is between half of said blade thickness and twice said blade thickness along the whole length of said blade.

7. An aerofoil as claimed in claim 1 manufactured as a turbofan fan blade incorporating said step;

said step depth is between half said blade thickness and twice said blade thickness at said blade tip;

said step tapers, from maximum depth at the tip of said blade, to zero depth at the root of said blade.

8. An aerofoil as claimed in claim 1 used for any kind of lift or downforce, thrust or suction or as an impellor.

ABSTRACT

A high lift stepped aerofoil section, incorporating a leading edge 1, trailing edge 3 and a step 2 to provide a higher vertical component in its construction; the aerofoil has greater perceived root thickness giving greater lift through compression 4 on the aerofoil undersurface. The section has high pressure area 5 below the aerofoil and low pressure area 6 above the aerofoil. The aerofoil has much higher strength on all axes than conventional aerofoil sections.

Use Figure 1

FIG 1

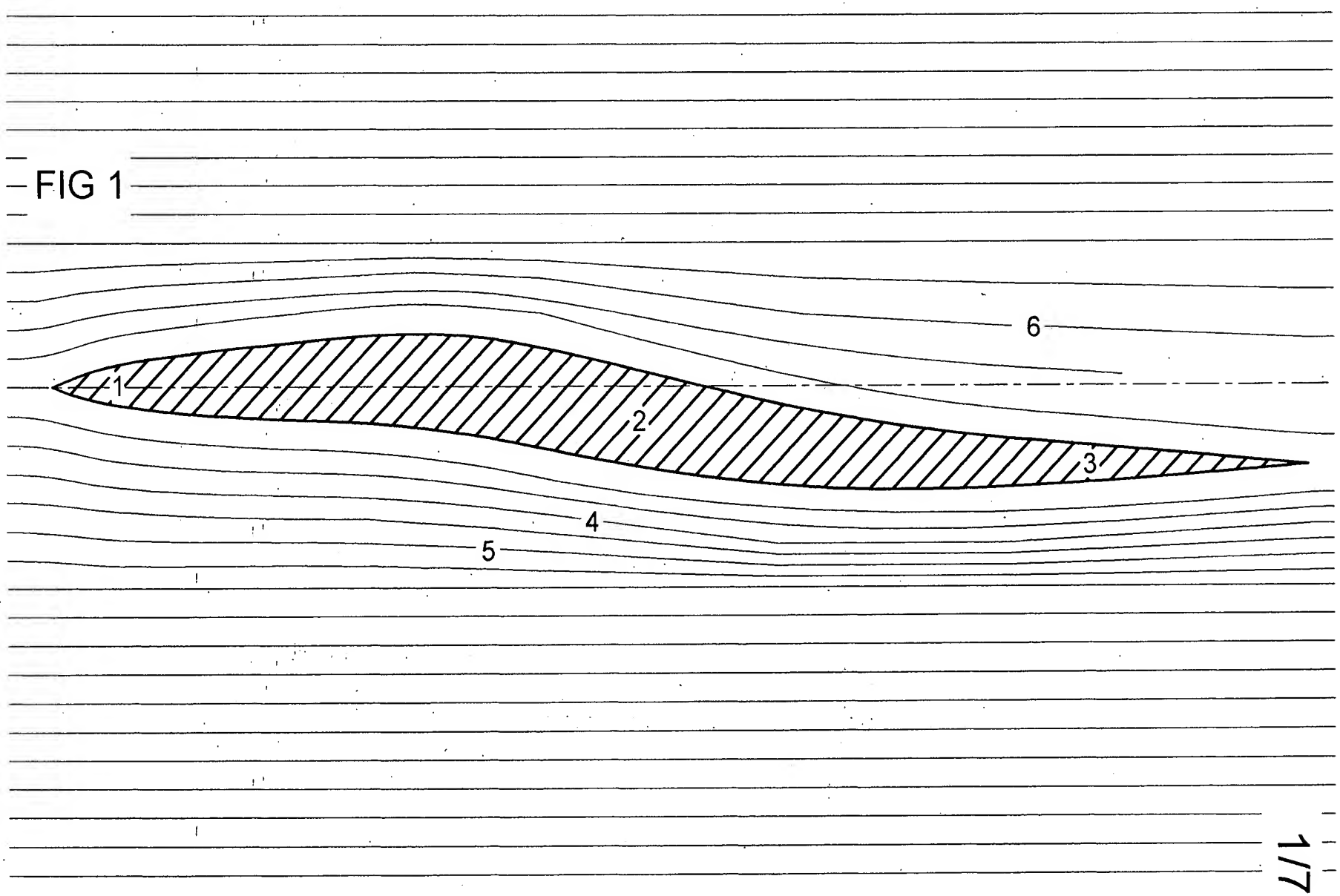


FIG 2

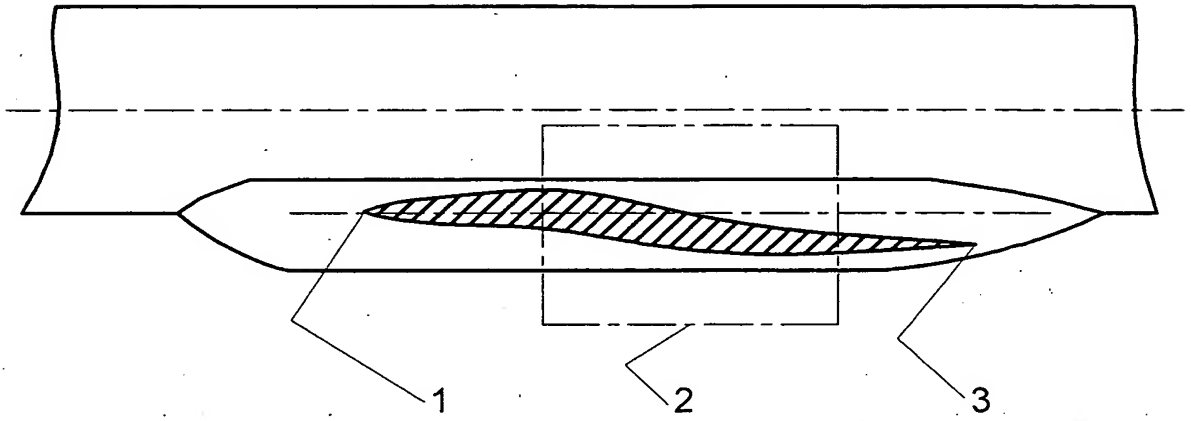


FIG 2B

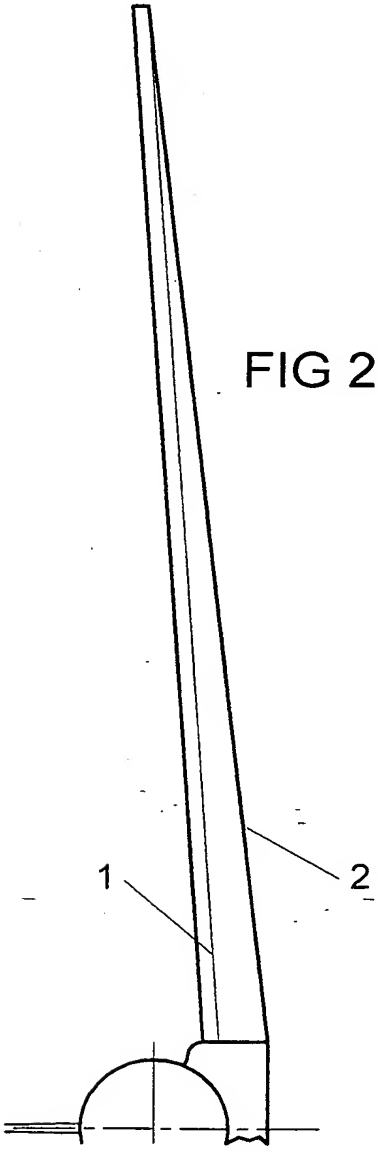
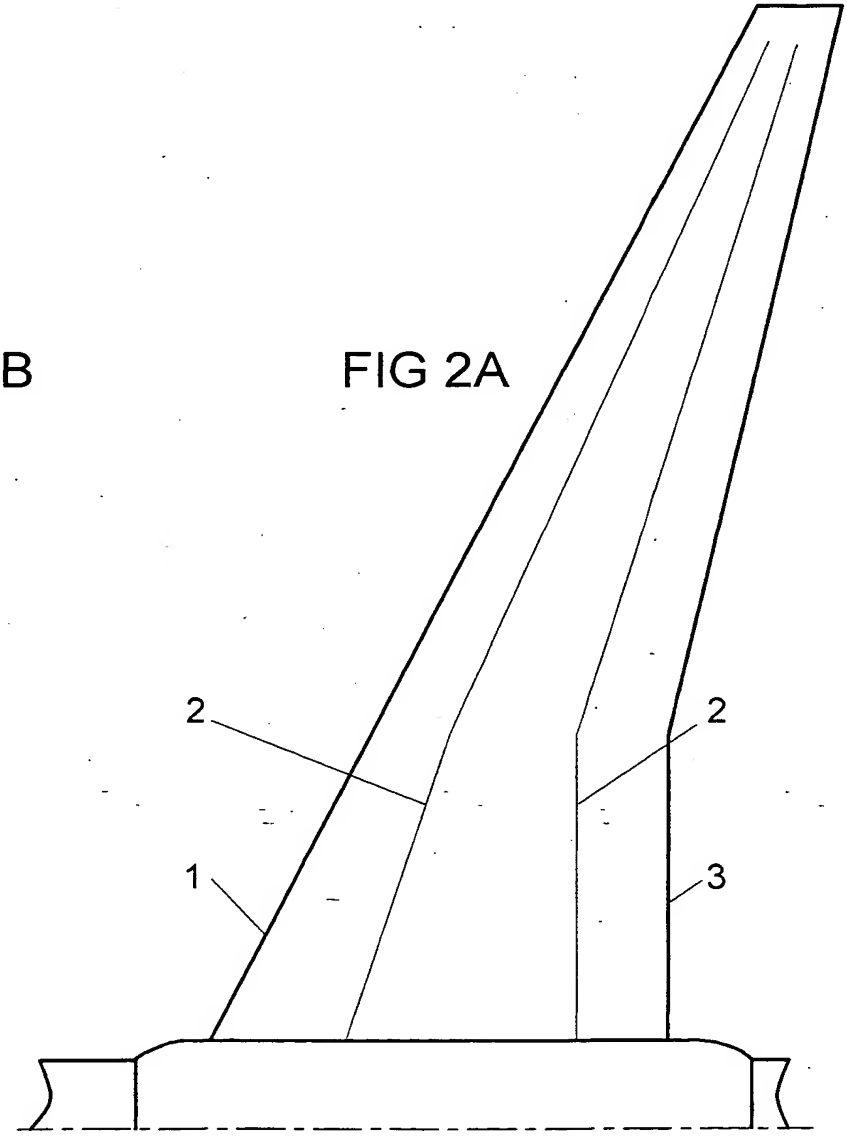


FIG 2A



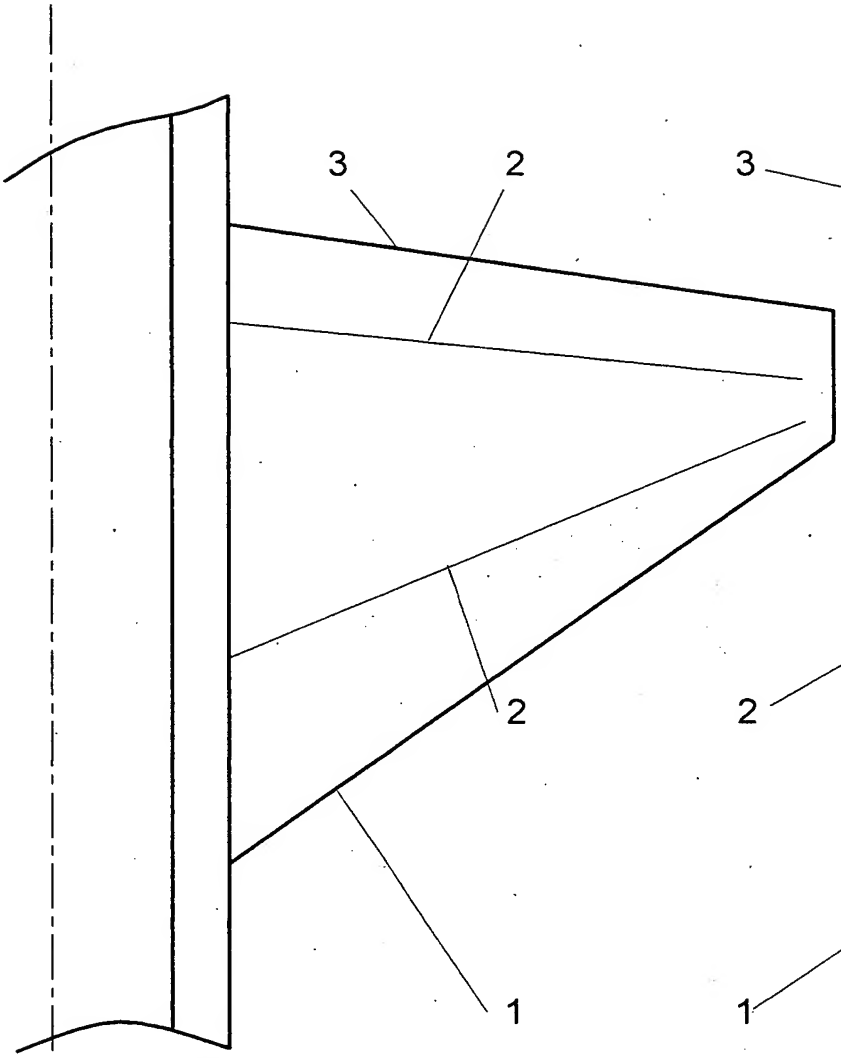


FIG 3A

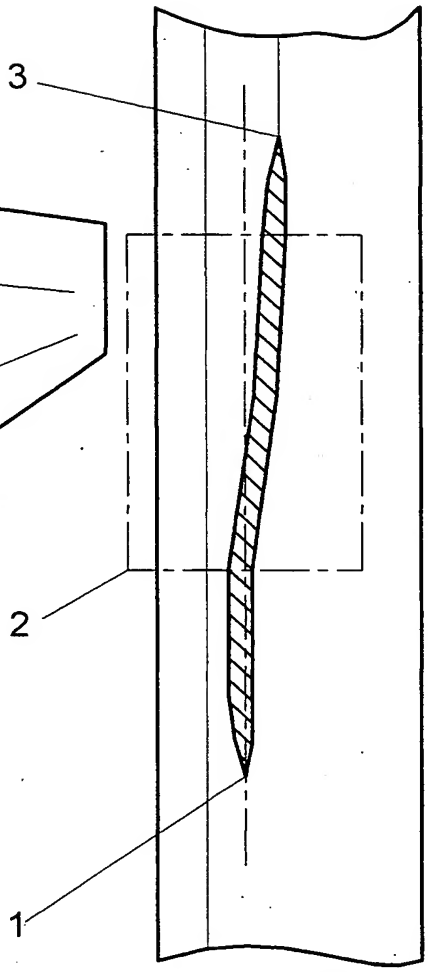
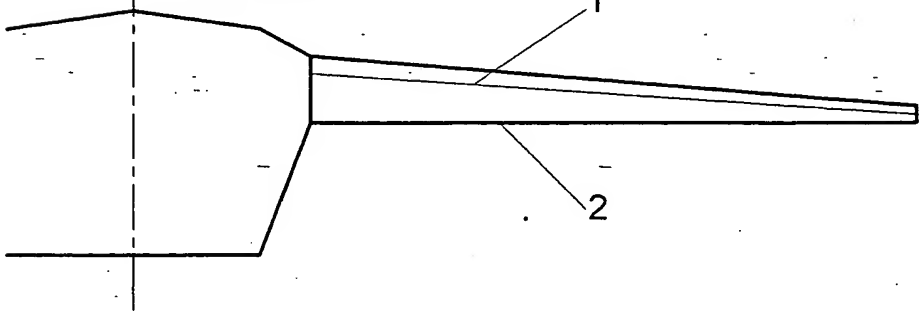


FIG 3

FIG 3B



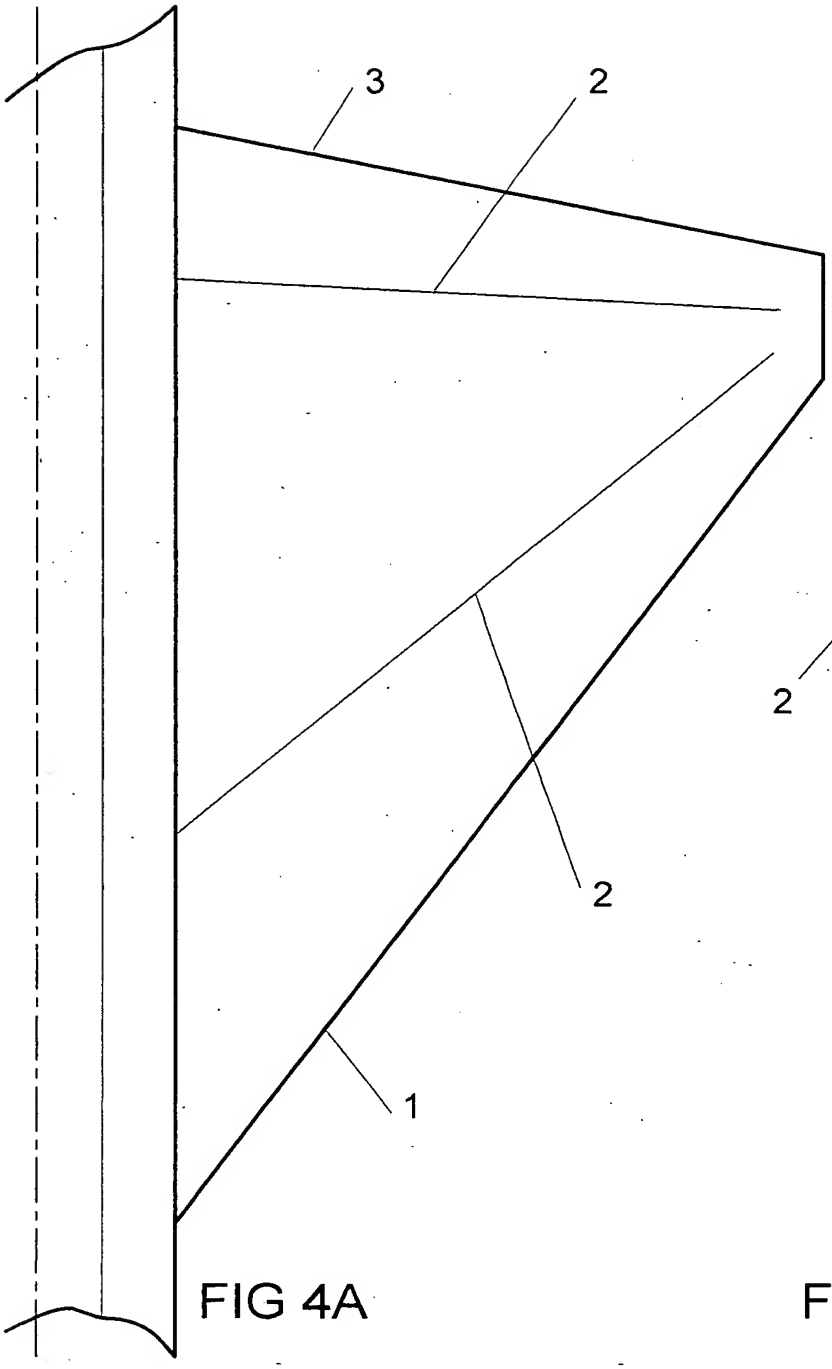


FIG 4A

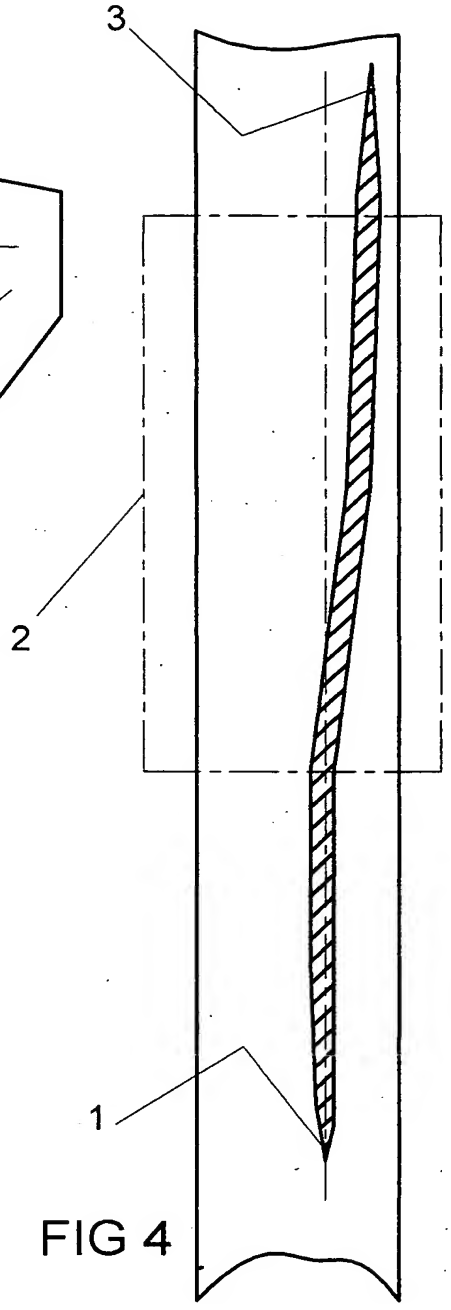


FIG 4

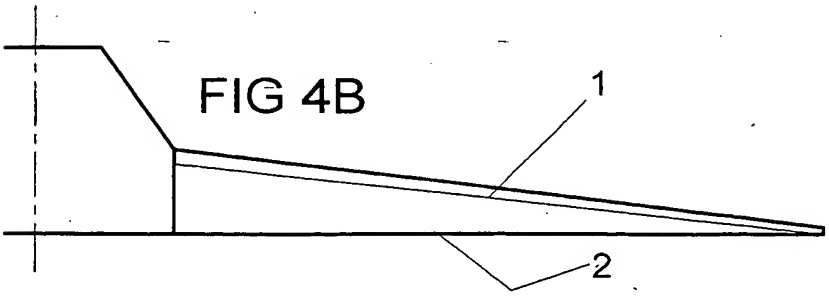
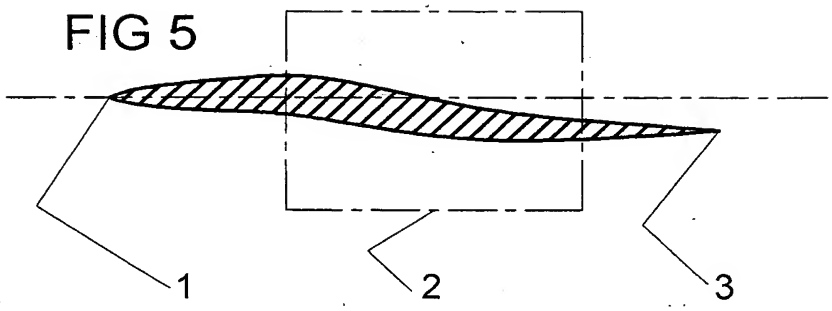


FIG 4B

FIG 5



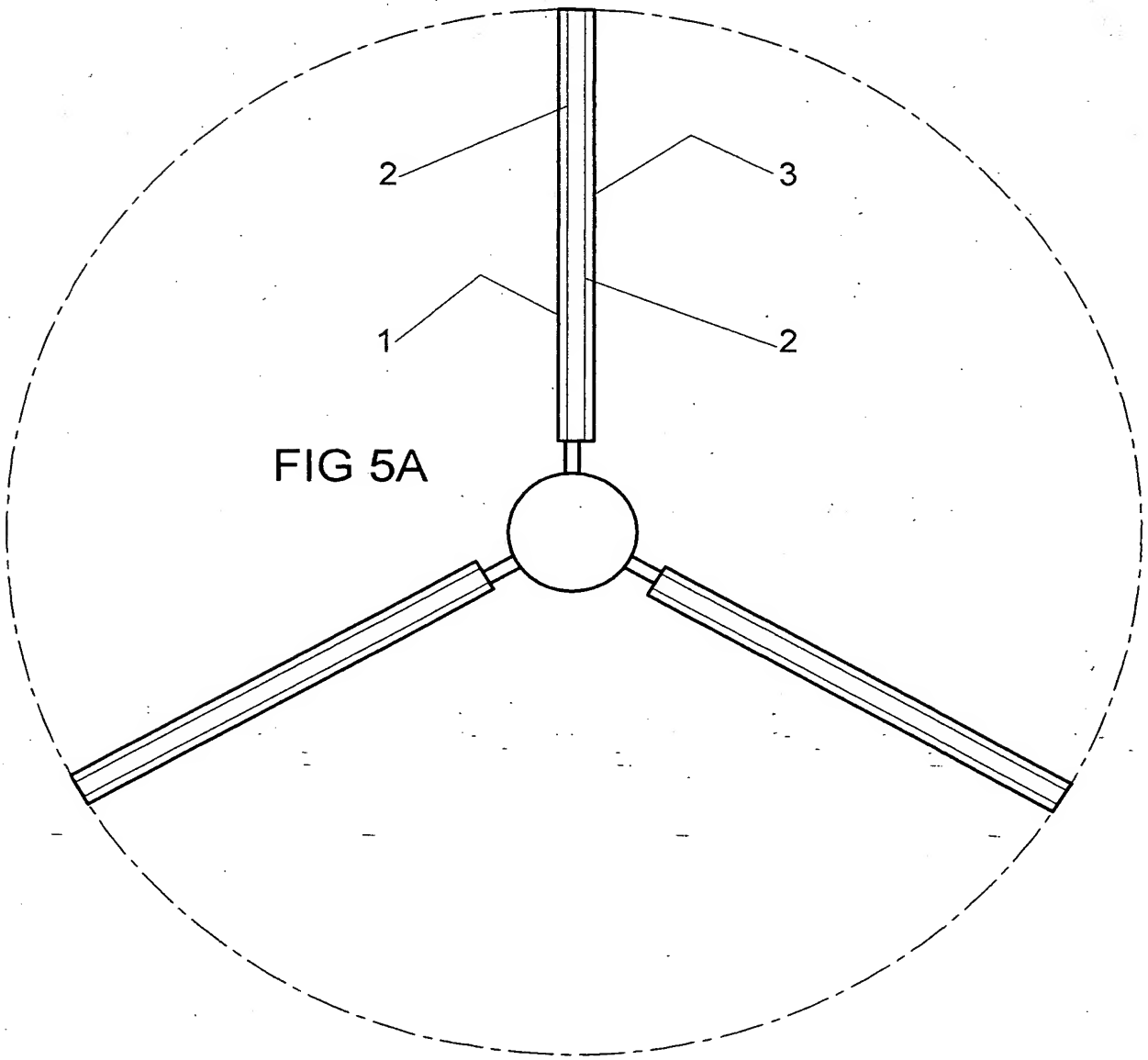
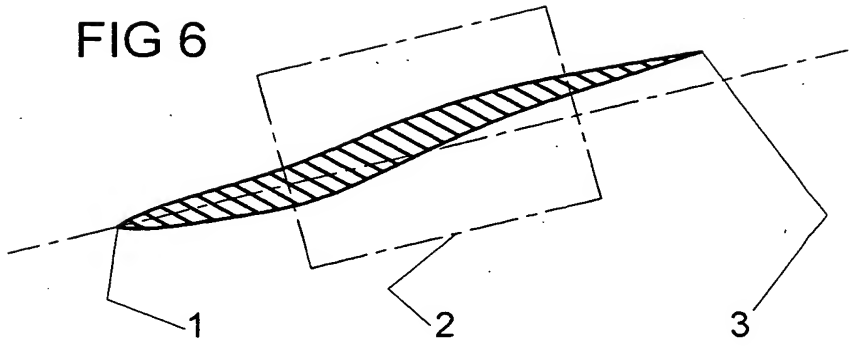


FIG 5A

FIG 6



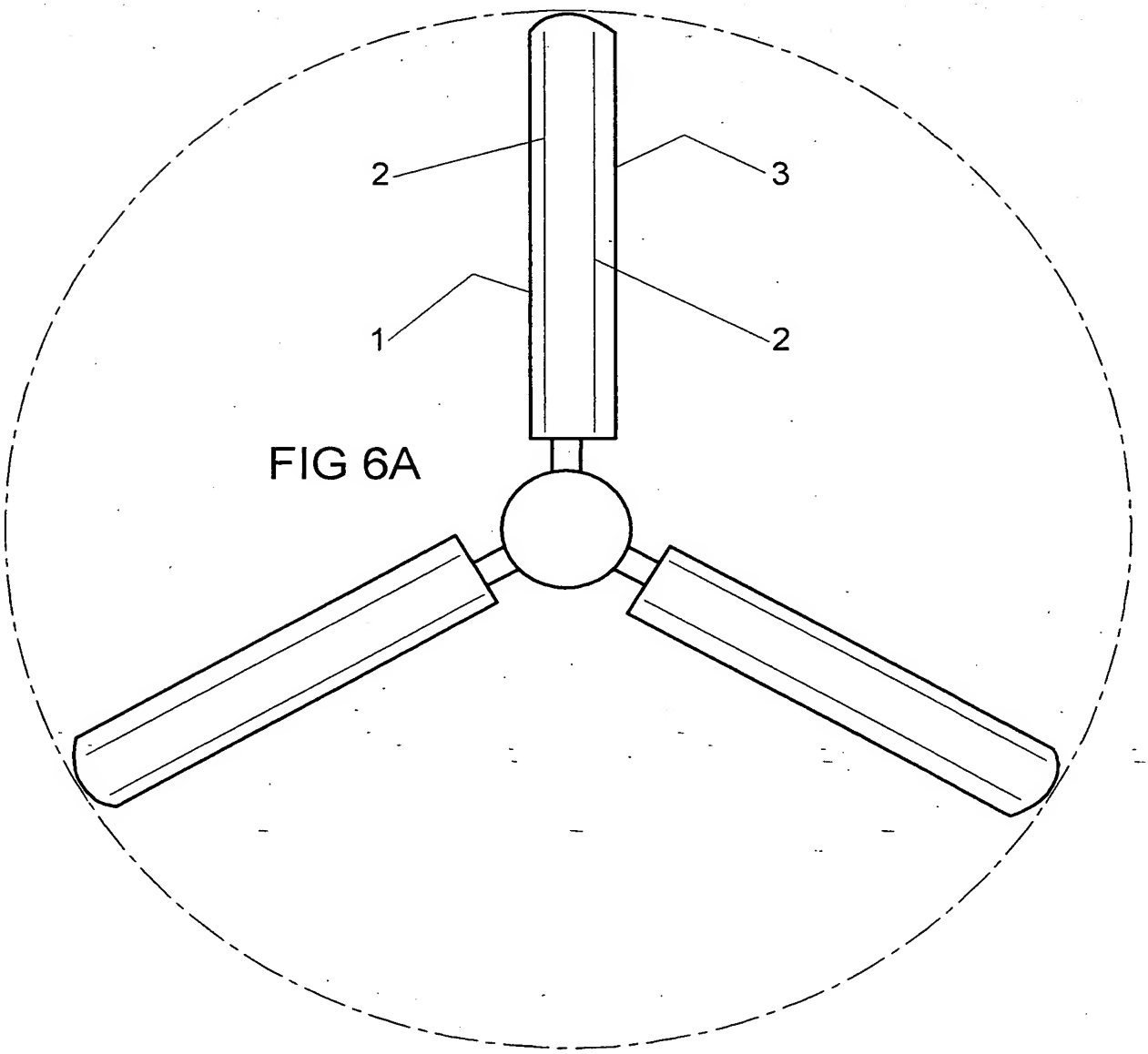


FIG 6A

FIG 7

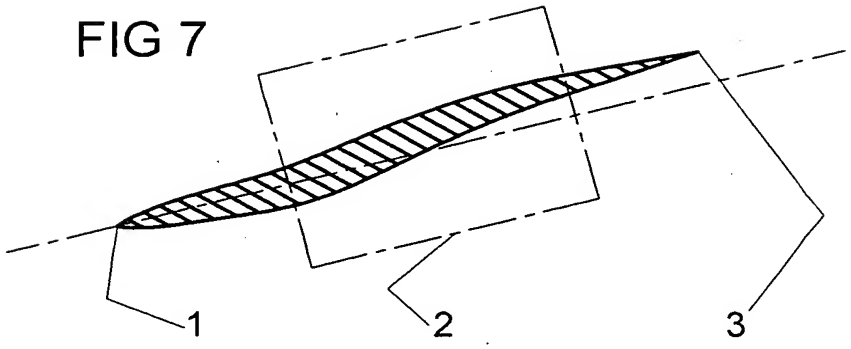


FIG 7A